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FACTS
FOR ENVIRONMENTAL STUDIES



Ministry
of the
Environment

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SET 7E

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Water Treatment Plants

Exploring the Outdoors with Young People

Window Field Trip (K-3)

The City Ecosystem



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WATER TREATMENT PLANTS

The provincial Ministry of the Environment is the government agency responsible for the management of water resources in Ontario.

As part of its water management function, the Ministry keeps close check on the quality of all municipal water supplies, and builds and operates water treatment plants and facilities for municipalities and other areas.

This fact sheet outlines the treatment method and equipment used to purify surface (lake) water for use by the community.

(Note: This is the type of treatment used for large communities. There are a number of other methods that may be used in supplying smaller areas with unpolluted water.)

The object of this treatment process is to take water from a surface source, remove any impure materials from it and send it to our homes odorless, colorless, free from undesirable chemicals and safe to drink.

INTAKE

To obtain the water, an intake pipe is laid from the plant into deep water. Water then flows through the pipe to a pumping station located on the shore. The station pumps the water to the treatment plant. Screens across the intake pipe and within the pumping station prevent fish and other objects from entering the plant.

MICROSTRAINER

If the water is being taken from an area that has a large amount of algae (plant life), it may be screened again. This screening unit is called a microstrainer and consists of a revolving drum covered with a finely woven stainless steel cloth.

FLOCCULATION AND SEDIMENTATION

From the microstrainer, the water flows into a large concrete tank called a "Flocculator". The flocculator contains large paddles which constantly agitate the water to prevent settling. At this stage, special chemicals are added which causes the small impurities remaining in the water to coagulate or thicken.

The water then passes into a sedimentation (settling) basin

where it is left for a period to allow the accumulated material, called floc, to settle to the bottom so that it can be removed.

SAND FILTERS

The water is still on considered only partially treated. It is now put through a filtering stage.

The filters are actually layers of finely graded sand or anthracite coal over layers of graded gravel which rest upon an underdrain system of perforated pipes.

The water flows over the top of the filtering material and down to the underdrains. The now clean water is collected and piped to a storage tank within the plant.

Once the clean water reaches the storage, it is practically ready for people to use. The last thing to be done is to kill any germs that may have slipped through. This is done by adding a small amount of the chemical called chlorine. Only enough is added to kill the germs and protect the water.

Ministry staff frequently visit various points around the distribution system sampling water in the pipes to ensure that the water is always of the highest quality possible.

EXPERIMENT 1

To evaluate paper and cloth filters.

Materials: window screen (12" x 12")
several different types of cloth (12" x 12")
paper towels (12" x 12")
toilet tissue
dirty water (water mixed with a few handfuls of soil)

Method: 1. Lay a piece of cloth over the window screen and
pour some of the water through.
2. Repeat using different pieces of cloth and then turn
the paper towels and tissue.

Questions: 1. Does pouring the water through the filter change
it?
2. If so, which one of the materials does the best
filtering job?
3. Do you think there is anything left in the water?
Would you be willing to drink any of this water?

EXPERIMENT II

To show flocculation and settling.

Materials: iron or aluminum salt (sulfate or chloride)
lime (calcium hydroxide)
muddy water
several quart glass bottles
eye droppers
marking pencils

Method: 1. Make a 5% solution of iron or aluminum salt.
2. Make a 5% solution of hydroxide slurry.
3. Thoroughly mix several containers with muddy water.
4. Mark one bottle as the control and put to one side.
5. Add 1 drop of iron to one container, 2 drops to another and 3 to another.
6. Repeat using lime.
7. Add 1 drop of iron and 1 drop of calcium hydroxide to a container, 2 drops of each to the next and 3 to the next.

Questions: 1. Is there any difference in the clarity of the bottle?
2. If so, which container has the best clarity?
3. Does the water appear drinkable? Would you drink it?
4. Which dose of flocculate (iron or aluminum salt) does the best job? Does of lime?
5. What combination works best?

EXPERIMENT III

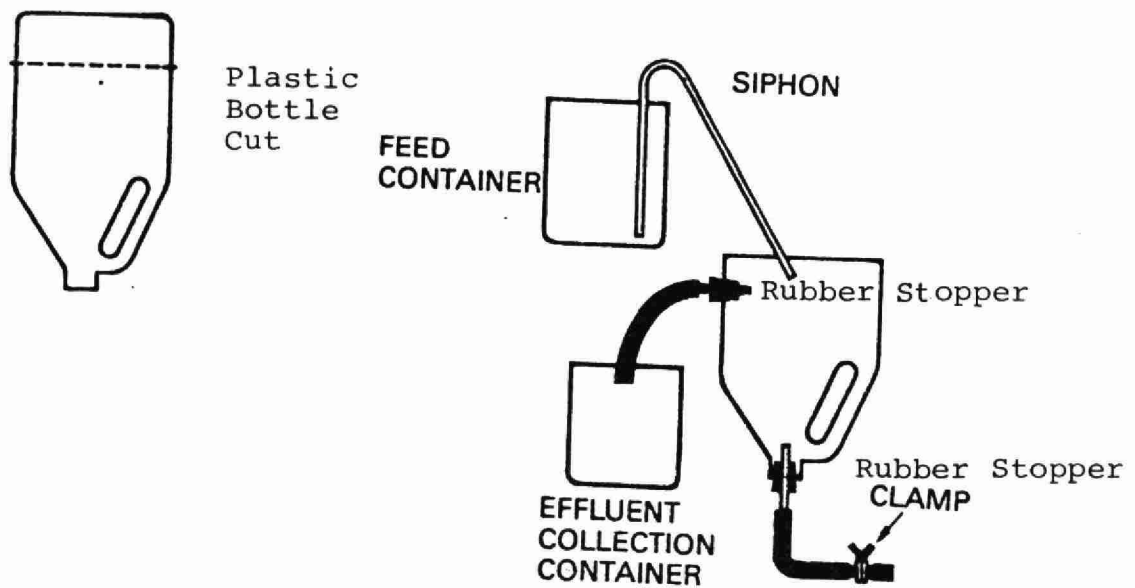
To demonstrate sedimentation.

Materials: 1 gallon plastic bottle (javex)
2 rubber stoppers
4-6 ft. rubber tubing (2 short pieces)
glass tubing
2 containers (label 1 feeder, the other effluent
collection)
muddy water
cork borers
tubing clamps

Method: 1. Cut 2" off bottom of plastic bottle and invert it.
2. Bore holes through bottle to fit stopper.
3. Bore hole through rubber stopper to fit glass
tubing. Connect rubber tubing to glass fitting.
4. Fill feed container with muddy water.
5. Start siphon feed to plastic bottle (clarifier) and
the tube to the effluent collection container.

Questions: 1. What does the clarifier do? How does it do it?
2. Where does nature use settling?
3. By looking at the process, does the clarifier do
its job well? Well enough to drink?

4. Remove clamp from bottom tubing. What happened?
5. Do you think anything has settled out?



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EXPLORING THE OUTDOORS WITH YOUNG PEOPLE

By Clifford Knapp

Children like going on field trips to explore the outdoors. Teachers and parents can help make the exploration a success for their students - and themselves - through planning. The next time you and your students leave the classroom, try some of the following suggestions for things to do, what to collect and how to display collections.

Tips for parents and teachers

1. Guide young people in using as many senses - sight, touch, hearing, taste and smell - as possible to explore the outdoors.
2. Try to see nature through the eyes of young people. Encourage role playing, pretending and creating new ways of experiencing nature.
3. Respond to and encourage young people's enthusiasm and curiosity for nature. Show your own enthusiasm and curiosity when possible. Try not to convey irrational dislikes and

fears of nature.

4. Develop simple guidelines for collecting natural objects.
(Where laws and common sense prohibit collecting, enjoy nature and leave it for those who come after you.) Provide places for young people to keep what they find. Cigar boxes, egg cartons, and shoe boxes are good storage places for rocks, weeds, cones, and seeds.

Nature Collection Guidelines

1. Collect things that have fallen to the ground or are not living. Don't harm any living plant or animal.
2. Ask permission before collecting objects on someone's property.
3. Avoid picking up sharp objects such as broken glass or thorns.
4. Avoid tasting or putting anything in the mouth unless a knowledgeable adult gives permission.
5. If you don't know the name of something in nature, have the young people make up a name based on some characteristics of that object. Don't let the lack of a name stop your observation.
6. Demonstrate a concern for living things. Be conscious of what attitudes young people are learning about death.
7. Read and provide books about nature. Try to find outside the

objects you read about. Help young people see how objects found indoors are connected to the larger world of nature outside.

8. Go outside in all kinds of weather. If people are dressed appropriately, nature can be enjoyed throughout the whole year.
9. Set aside a bulletin board, chalkboard, or nature corner where objects and pictures of nature can be displayed.
10. Provide opportunities for young people to make choices and decisions while learning from the outdoors.
11. Encourage co-operation, sharing and teamwork among young people as they study the outdoors.
12. Stress the positive aspects of nature such as beauty, balance, variety, complexity and rebirth.

Role Playing and Imagining

1. Pretend you are a raindrop hitting the ground. Walk where you would roll.
2. Pretend you are a bird. Make a nest with materials you find outside. (Caution: If you are collecting bird nests take them only after they are abandoned in the fall and early winter).
3. Talk to trees, rocks, and other inanimate objects. Imagine what they would say back to you.

4. Move your body like trees in the wind, clouds moving across the sky, raindrops falling in a puddle, or snowflakes being blown by the wind.
5. Role play "Johnny Appleseed", spreading and planting different types of seeds.

Fun and Games

1. Make parachutes by tying objects to strings attached to the corners of large handkerchiefs. Throw them into the air.
2. Make and fly a kite.
3. Find natural objects and ask as many questions as you can about each one.
4. Select an object and say, "This is a _____, I like it because".
5. Blindfold children. Have them guess what kind of object is handed to them. Lead them in a line to different places. Have them guess where they are and what is happening.
6. Make boats from materials found at home and in nature. Find out which supports the most weight and or goes the fastest.

Spring and Summer

1. Make a water scope by removing the bottom of a plastic pail and covering it with cellophane to use in looking below the surface of water.

2. Press plasticene clay to tree bark and other textured objects to collect textures.
3. Bend a wire coat hanger into a circle. Toss it on the ground and observe carefully.

Fall

1. Tear a fallen leaf into pieces. See if others can put the puzzle together again.
2. Find different shaped leaves and put them in categories that young people make up.

Winter

1. Catch snowflakes on dark cloth and examine them with a lens.
2. Fill pine cones with seeds and suet and hang them on trees for birds.
3. Open up a large bud (magnolia) and find the small plant parts inside.
4. Make tracks in the snow and try to track others. Make track puzzles. Have others guess what happened.
5. Sprinkle rock salt on ice and snow and see what happens.

Group Problems

1. Build a shelter using natural materials that will protect you from rain or snow.
2. What is the best way to keep the whole group warm outside on a cold day.

Values

1. Go to your favourite spot. Stay there for a while observing the natural surroundings.
2. Describe the natural object you like best, a bird, for instance.
3. What would you want to save first if a flood were coming?
4. What can you hear that you like best?

Pollution

1. Recycle aluminum or newspapers.
2. Put out pieces of cardboard with thin coats of petroleum jelly spread on them to capture particles of polluted air.
3. Pick up three different kinds of litter.
4. Do something to make the area more beautiful.
5. Look for ways that people pollute.
6. Melt a can full of snow to see how dirty it is.

Arts and Crafts

1. Pick dried weeds and arrange them in containers.
2. Make paint brushes from pine needles, weeds, and other found objects to use for painting pictures.
3. Rub pigments from nature on light coloured sandpaper. Create a picture using natural colours.
4. Make a nature collage. Cover it with clear contact paper. Make stained glass windows with the contact paper and natural objects.
5. Make a blue print from natural objects.
6. Make silhouettes of natural objects by putting tempera paints in a plant mister and spraying the object placed on paper.
7. Find objects in nature shaped like circles, squares, triangles, rectangles and other shapes.

Science

1. Put some soil in a jar of water. Shake it up. Allow the soil layers to settle and examine them.
2. Dig a hole in the ground and glue the different layers of soil on a piece of cardboard with rubber cement to make a soil profile.
3. Spread butcher's paper or an open paper bag on the ground under a bush or shrub. Shake the branches to capture insects that fall.

4. Turn over rocks and boards to find animals living underneath them. Put everything back when you are finished looking.
5. Adopt a tree. Observe it throughout the year.
6. Make a wind vane from a soda straw, pin, bead, feather and pencil to find wind direction.
7. Dig up a dandelion to see how long the roots are. See if you can get the whole tap root without breaking it.
8. Put natural objects of the same type - seeds, shells, or rocks - in empty cigar boxes. Tape them shut. Have people guess what is inside by shaking the boxes.
9. Collect seeds in envelopes. Separate them according to how the seeds travel.
10. Find the seeds in a pine cone. See how they flutter to the ground. Tear the cone apart like a squirrel does to find seeds.
11. Examine different kinds of seeds in a bird feeder. Try to sprout them between layers of wet paper towels.
12. Predict how much water will be displaced by dropping different natural objects in a container filled with water.
13. Make predictions about where balls will roll if released. Release them and see if you're right.
14. Arrange the rocks, seeds, twigs or other objects in groups according to similar characteristics.

Numbers and Record Keeping

1. Find the biggest tree, rock or other natural object around.
2. Keep records of rainfall, snowfall, and temperatures by posting a calendar.
3. Make your own tape measure with a knotted string. Use it to find different circumferences (e.g. tree trunks at shoulder level, utility poles, your arm above the elbow, the calf of your leg and a chair leg.)
4. Count the number of pine needles in each bundle to see if the number varies from one kind of pine to another.

Music

1. Make tape recordings of different outdoor sounds.
2. Collect objects from nature to make rhythm and musical instruments.

Nature in the Classroom

1. Collect different odors in plaster filled jars with lids. The plaster holds the odor especially if oils or other liquids are absorbed into the dried plaster.
2. Put natural objects in cloth bags or shoe boxes. Reach into them to identify them by touch. Be careful not to use poisonous plants or animals.

3. Make terrariums and keep small animals. Be sure you know the proper diet and environmental conditions for each animal.
4. Try growing seeds and plant parts of fruits and vegetables found outside or purchased at the grocery store.
5. In fall or winter collect a pot of soil and place it in a jar. Water it and watch it to see whether plants grow.
6. Take cuttings from trees and shrubs after they have lost their leaves. Place them in containers of water to observe whether they leaf and flower.

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WINDOW FIELD TRIP (K-3)

Equipment: drawing paper
crayons

Inside-Outside Activities

1. Explain to the children that today they are going to look out the window to answer questions about the things they see. Later they can draw pictures of what they saw through the window.
2. Hand out sheets of paper to the children and show them how to draw the outline of a window frame.
3. While the other children are working on this drawing take groups of 5-6 children to the window for a few minutes at a time.
4. The following are examples of some of the questions that you might like to ask:

Weather

Can you tell if it is hot or cold outside? How?

Is there any wind today? How do you know?

Where is the sun?

Can you see the moon?

Can you tell what season it is?

Do you see any clouds? What shapes do they remind you of?

Can you see any shadows? If not, why not? If you can are they all pointing in the same direction? Why?

Counting

How many cars can you see? Birds? Buildings? Trees?

Colours

Can you see a white house? A green roof? Can you find something red?

Let's try to find every colour of the rainbow?

Shapes

Can you find a triangle? (Roofs and trees outlines are good for this?) A square? A rectangle? A circle?

Comparative Size

Is the "Christmas" tree taller or shorter than the flagpole?

Is the telephone pole shorter or taller than the school?

Roofs

If you overlook a flat roof, look for standing water, trash,

twigs, and even moss and talk about how they got there. Talk about reflections in any standing water. Talk about the advantages of pitched versus flat roofs.

Wildlife

If you are lucky, you'll see a squirrel or two or maybe some birds. Have the children watch them closely and describe what they see.

Sounds

If weather permits, open the window and see if you can identify any sounds.

Follow Up

After each group of children has been to the window have the students draw some of the things they saw and talked about on their "field trip".

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THE CITY ECOSYSTEM

An ecosystem is the interacting system of a living community and its non-living environment.

A city is an ecosystem because it is composed of organisms interacting with each other and involved in energy transfer and materials cycling.

In any ecosystem, the most successful species is one that is able to channel energy and recycle materials so efficiently that a closed system develops which allows resources to be conserved and the species to be maintained.

In order that an ecosystem remain stable it is necessary for it to have a large number of species interacting with it. The greater the number of species the less likely it is for a particular species to grow explosively and to upset the system. In addition, although external forces could upset part of the system, the chance of a total upset of the ecosystem is minimized due to its complexity (large number of species.)

MAN'S INFLUENCE ON THE CITY ECOSYSTEM

Man is a disturbing force in the urban ecosystem. He diverts energy, water and other materials from natural systems and creates his own unstable systems.

1. Can you think of any activities which man undertakes to modify his environment?

Possible Answers: tilling }
 logging } removing of vegetation cover
 burning }
 earth moving
 land drainage
 industrial activities - pollution
 housing
 manicured gardens
 introduction of exotic species
 paving
 illegal shooting of animals
 trapping

By changing the characteristics of his environment, man alters the competitive relationships between species so that some can survive better than others.

CHANGES IN THE PHYSICAL ENVIRONMENT

The construction of large urban centres with emphasis on the creation of environments comfortable to man has meant numerous changes in the natural environment.

2. For example, how does man's need for water and energy
affect the physical environment?

Possible Answers: waterways are diverted
flood plains are altered
vegetation is removed for building construction
pavement causes surface water run-off
pavement results in lowering ground water reserves
energy producing plants create pollution

THE EFFECT OF THE CITY ON CLIMATES

Within the city there is a series of micro-climates which are caused by the local topography and such things as the type of land use.

For example, areas designated as parkland may have a temperature 2-3°F lower than the nearby residential streets.

Airflow also is altered by the presence of buildings and their relative positioning.

Cities usually have lower levels of humidity than do rural areas because the large amount of concrete leaves little room for vegetation that can absorb moisture.

3. On your walk to and from school is there any corner which
seems colder? Why?

EFFECTS OF CHANGING TECHNOLOGY OF ANIMALS

Up until the 1940's many organisms could adapt to the changing urban scene. However, technical changes have proved too great for many species.

Some examples are:

- A. Erection of tall buildings in the path of traditional migrating routes for birds kill thousands.
 - B. Utility poles used to serve many birds as gathering places, sites for hole-nesting and roosting spots. Nowadays, most utility wire are run underground.
 - C. Fewer reptiles and amphibians can be found in cities than in former years due to the scarcity of open water in cities.
4. Can you think of more ways that plants and animals are affected by man's technology?
-

- Possible Answers:
- A. Warmer water from power station outfalls influences aquatic plants.
 - B. Birds flying into airplanes.
 - C. Esthetic damage to buildings.
 - D. Tree roots destroying pavement.

EFFECTS OF URBAN. PHYSICAL ENVIRONMENT ON PLANTS

5. What things do green plants require to grown and reproduce?

Answer: light

carbon dioxide

water

various elements and compounds found in the soil

6. How does the city environment influence plants?

- Possible Answers:
- A. Buildings reduce light.
 - B. Dust from industrial processes coats leaves and prevents the plants from absorbing the amount of sunlight they require for photosynthesis.
 - C. Artificial light from street lights encourages plants to flower even when the natural length of day discourages it.
 - D. Pollution harms some plants.
 - E. The low humidity in a city puts a lot of stress on plants.
 - F. Precipitation washes pollutants out of the atmosphere onto plants and into the soil.

7. How does the city environment influence animals?

- Possible Answers:
- A. Artificially lengthened days influence the activities of birds.
 - B. Warmer temperatures in the winter reduce the mortality rate of city birds due to the cold.
 - C. Waterfowl use city waters for roosting and feeding.
 - D. Insects requiring water for their life stages (i.e. mosquitoes) may find it difficult to reproduce in great numbers in the city due to the scarcity of water.
 - E. Reduced plant cover and low humidity makes existence difficult for organisms such as worms that depend on moist soil. In turn, this affects the birds that feed on the organisms.